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STATUS REPORT ON INTERNATIONAL INTERACTION--DECEMBER 1970 - JANUARY 1971*

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This paper is the third in a series of reports issued by the World Event/Interaction Survey (WEIS) to summarize the status of the development of procedures for monitoring international interaction. Our first report introduced a method for monitoring international behavior by establishing non-crisis or normal levels of interaction against which we compared current activity.[1] The measure of the volume of international interaction detects departures from what might be considered nations' normal level of behavior--based upon WEIS interaction data from the previous five years. In our second report we expanded the method from two to twelve indicators for each of 118 countries.[2] The broadened scope focused upon delineating between cooperative and conflictful behavior and comparing them to behavior history standards of one and five years in length.

The limitations of this technique have been two-fold. First, the considerable manual effort required for the computational process severely limited its application to all nations throughout the full run of WEIS historical data. Second, further exploration of indicators based upon selecting and combining behavior categories was operationally infeasible, even with a relatively small number of nations. These problems have been mitigated by implementing a computerized process able to perform all monitor functions without manual intervention. This report presents the results of its application to all 160 international actors carried in the WEIS data collection. In addition we are now introducing the behavior indicator, "HREL", a proportional measure of the variety of alternative acts a nation might employ as it conducts its international political business. We will describe our conceptual rationale and present preliminary observations. Portions of the HREL monitor have been auto-

mated with present plans slating it for inclusion within the overall international interaction monitoring system and short-range prediction model now under development on the WEIS project. Our approach in this paper is to discuss HREL followed by presentation of the substantive observations from each monitor method for December 1970 and January 1971. Our description extends the detail we normally employ in these reports and the indulgence of the reader is requested; however we believe it appropriate to document the HREL rationale at its time of introduction.

In our first two reports we outlined the concept of monitoring international behavior by measuring deviations in the volumes of interaction between political parties. When their activity departs over two standard deviations from what past performance would lead us to expect, the participants' activities are flagged as "unusual." Our studies for the months of September through November 1970 demonstrated a sensitivity to a wide range of interaction situations and included a facility to discriminate between the receipt and transmission of unusual international behavior.

The information statistic HREL is another research technique for monitoring international activity. Whereas the standard deviation procedure originates in parametric statistics and gauges volumes of interaction, HREL comes from Information Theory and is a measure of the variety of behavioral categories employed in an interaction. Its theoretic base is found in the work of Shannon and Weaver and their measurement of the information content of sets of alternative events.[3] Its application to the study of international politics was first suggested by Charles A. McClelland in a series of papers investigating acute international crises.[4] McClelland successfully demonstrated its conceptual relevance by empirical investigations of the Formosa Straits and Berlin Wall Crises. He did not, in the absence of adequate computer assistance, extend the lengthy manual calculations to the general WEIS data collection. Recently an automated HREL processor was completed as a module within the WEIS international interaction monitoring system. Its development substantially increases the scope to which HREL may be applied and permits analysis of the full run of our event data. The following sections

include a brief introduction to the HREL concept, its relevance to
event-interaction analysis, computational procedures and conclude with
its survey of our December 1970 and January 1971 behavior data.

The HREL Concept

The application of HREL to international politics originates in
Charles McClelland's observation that nations display an increasingly
broader scope of action alternatives as they become progressively more
involved in crisis situations. This movement out of the "rut" of rou-
tinized international activities signifies the onset of critical situ-
ations that by their very nature threaten customary relationships. This
departure from "normal" administrative and decision-making processes is
marked by increased attention by higher authorities to the circumstances
surrounding the situation.[5] If the usual corrective measures fail, alter-
natives are employed that may be uncharacteristic or rarely observed in
the unstressed relationship.

McClelland observed two phenomena in his event data. First he found
that nations displayed a wider range of behavior as they became progres-
sively more involved in situations threatening their interests. While the
total number of acts output by a nation might remain at routine levels,
the variety has increased beyond what is considered routine interaction.
As a series of circumstances impinge upon the usual problem-solving acti-
vities and exceed their conflict-resolving capabilities, the interaction
process appears to depart from the customary practice by an invocation of
corrective activities. McClelland found supporting evidence in both his
Formosa Straits and Berlin Crisis studies. Second he found that the
expansion in the variety of observed action categories could be measured
by means of the HREL technique. His findings suggested values of HREL
exceeding 0.700 defined crisis conditions. In a similar investigation
John D. Sullivan proposed that HREL values greater than 0.600 were
sufficient to quantitatively define critical situations.[6] Both resear-
chers were able to observe the same phenomena--increased variety in
tense situations. For our work we will employ the lower figure.

HREL Computation

The notion of HREL derives from information theory and the post World War II mathematical analyses of C. E. Shannon of the Bell Telephone Laboratories.[7] Its application to psychology and the social sciences is in large measure due to the subsequent work of Cherry (1957), Attneave (1959), Osgood and Wilson (1961), and Garner (1962). HREL itself expresses the relationship between the reduction in uncertainty (information loss) associated with the occurrence of an event that is known to be a member of a set of different events, any of which could occur in accordance with given probabilities. Information value 'h' is defined in terms of "bits" and relates logarithmically to the number of possible alternative events available to the originator. If we had a set of 'n' equally probable events, then the information loss or uncertainty reduction per event would be:

$$h = \log_2 n \quad \text{bits/event} \tag{1}$$

If a relationship of 'm' events were observed from this set of 'n' unique equiprobable event categories, then the information loss possible per each set of events (circumstances or situations) would be:

$$h = m \log_2 n \quad \text{bits/situation} \tag{1a}$$

Now if we have 'n' unique event categories in our situation, and if we either know with what probability each event will occur, or assume their equiprobability 'p' then 'n' and 'p' are related such that:

For equiprobability: $\quad p = \dfrac{1}{n} \quad$ or $\quad n = \dfrac{1}{p}$

and for unequal event probability 'pe_x' we find: $\tag{1b}$

$$pe_1 + pe_2 + pe_3 + \ldots pe_n = 1$$

For any circumstance of equiprobable events equation (1) may be expressed as:

$$h = \log_2 \frac{1}{p} \quad \text{or} \quad h = -\log_2 p \tag{1c}$$

In the case of our unequal event distribution, the expression would appear
as:

$$h = \log_2 \frac{1}{pe_x} \quad \text{or} \quad h = -\log_2 pe_x \qquad (1d)$$

This leads to our final defining equation for the total information
that may be contained in a circumstance or situation of 'n' unique types
of events:

$$H = -\sum_1^n pe_x \log_2 pe_x \qquad (1e)$$

where "H" represents the summation of the properly weighted event probabi-
lities.

From equation (1c) we observe that the dependent variable 'h' ranges
as a function of logarithm base 2 of the inverse of its probability. The
relationship states that given the known frequency of each event within
the population of unique events comprising the situation, the information
conveyed by each occurrence of an event is inversely proportional to its
probability. Shannon referred to these h-values as "surprisal." Event
behavior with low probabilities would surprise the recipients and convey
more information about the pattern and structure of the interaction situ-
ation than receipt of the higher probability routine events. In crisis
situations, the intensifying input-output interaction responses stimulate
increased use of low-probability events, and relates to McClelland's
notion of departure from routine behavior.

If the circumstance or situation can be described in terms of events
that are binary in function, that is, observed or not observed, are
mutually exclusive, and occur with some degree of probability, application
of equation (1e) is appropriate. We believe the WEIS set of twenty-two
behavior categories fits this prescription. Our knowledge of the proba-
bility (from observed past behavior) for each of the events enables us
to calculate the expected information contributions of each event cate-
gory for each time period or circumstance. For example the event "ACCUSE"
(x=1) with a probability of .10 ($pe_1 = .1$) as part of a larger population
of events has an information value of:

From equation (1c):

$$h = -p \log_2 p$$
$$= -.1 \log_2 .1$$
$$= -.3322$$

As we are interested in absolute values only, we may ignore the negative sign. The significance of the relationship lies in its emphasis upon events of low probability. For example a situation described by event observations belonging to either of two categories with probabilities of .10 and .90 respectively would have a total expected information value equal to the sum of the h-values of category 1 and category 2. Computations with equation (1c) would find these to be $h_1 = .332.$ and $h_2 = .1368$, and $h_1 + h_2 = H = .4690$ (we recall the sum of all h-values is represented by capital "H"). Category 2 is clearly the routine event-- its occurrence would not surprise us since we are pretty sure (90%) of its appearance. On the other hand this routine behavior does not convey much information about the event set--less than one half that of category 1. The notion of the surprise enters with the appearance of category 1, when the odds against it are 9 to 1. We are, to some degree, "surprised" while gaining considerable information about the probable event-set pattern since the odds remain in favor of the reappearance of category 2. Consider now a situation where we will employ this two-category event set to describe the condition of a system of interaction through a series of time periods TP_1, TP_2 . . . TP_n. Our observations have led us to expect about ten events per time interval distributed in the proportions stated earlier.

Multiple occurrences of categories do not alter the total information value, but it does again emphasize the notion of surprise. The information conveyed by one occurrence of a category is equal to the total information value of that category divided by its expected frequency (f). Hence each occurrence contributes h/f information about the nature of the event pattern. From our previous example the contribution by a single occurrence of either category is seen as:

Category 1	Category 2

$$h_1 = .3322$$

$$f_{expected} = 1$$

$$h_{occurrence} = .3322/1$$

$$= .3322$$

$$h_2 = .1368$$

$$f_{expected} = 9$$

$$h_{occurrence} = .1368/9$$

$$= .0152$$

We will not be too enlightened by a single occurrence of category 2. If, on the other hand, category 1 appeared more than once our information about the event set would markedly exceed what we expected. Our "surprise" is high and our attention diverted by the non-routine turn of events. Conversely, the non-appearance of category 1 could mark unusually dull or super-routinized behavior. The constant repetition of the highly probable category could indicate the ultimate or "compleat rut."

The task remains to operationalize this technique in a manner appropriate to event interaction analysis. Certainly a two category event set does not contain much information (.4690), and while we might achieve satisfactory results investigating cooperative/non-cooperative systems it would obscure the variety phenomena we wish to measure. To measure varietal expansion/contraction we need enough categories to define those actions that interest us but not so many as to destroy the mutual exclusiveness of our behavior categories.

So far our focus has been upon the mechanics for computing the information value of a set of event-categories. For any given situation described by an event set of 'n' categories we are able to compute H if we know the event probabilities (pe_x) for all categories. Recalling our notion of routine/non-routine behavior, the selection and control of the independent variables n and pe_x must function as the conceptual link between theory and observation. We have argued that an expansion of event variety indicates a departure from routine--and so too for contraction. We have suggested that H is a viable indicator. What remains to be done is to prescribe parameters for the independent variables (n, p) and the relationships they must take to make the H-values meaningful. The number of categories is delimited by the international system situations to

be measured. In our case we will employ the WEIS set of 21 event categories, for an 'n' of 22. We must also discriminate between values of expected probabilities (pe_x) derived from observation and those defined by our theoretic notion of routine/non-routine behavior, but we are ignorant of the proportional relationships appropriate to our purposes. We desire an H sensitive to the system changes in state. It must also be standardized; that is, relate to some pre-defined criteria consistent throughout all system states.

With H, computed in accordance with equation (1e), we have an indicator of varietal distribution for any given situation. Our requirement however is for an indicator relating the observed varietal distribution of the situation to a hypothesized, or at least consistent, standard. McClelland recognized the difficulty in establishing a standard defined by the data, so he suggested an arbitrary one based upon our previously discussed assumption of equal probability. Thus any system of 'n' categories functions in accordance with relationships drawn from a standard lying somewhere on the logarithmic least squares line from 0 to 'n'. See Figure 1. Any event category system, if related to similarly derived standards, yields similar results for all values of n. The "sensitivity" or refinement of the indicator, however, is a function of the slope of the least squares line at its intersection with the number of categories used to compute the standard. From this we recognize practical limits to the range of categories in our event set. Superimposed on Figure 1 are the systems of events presently employed in WEIS research. The range of 5 to 55 categories appears to represent the practical limits beyond which detail becomes either lost or excessive.

The variety measure must relate observed events to its hypothesized standard. Before doing so, one last word is in order enlarging upon our justification for the equiprobable ($H_{maximum}$) standard. Our prime consideration is to measure relative change--thus some skepticism may be tempered by our restatement that we do not suggest that a decision-maker will eventually employ his full range of action alternatives in equal proportions, but rather we desire to establish a logical benchmark for measuring his proportional changes in selection of behavioral alterna-

FIGURE 1

VALUES OF HREL FOR EQUAL OCCURRENCE OF ALL
EVENTS IN A SYSTEM OF 22 CATEGORIES
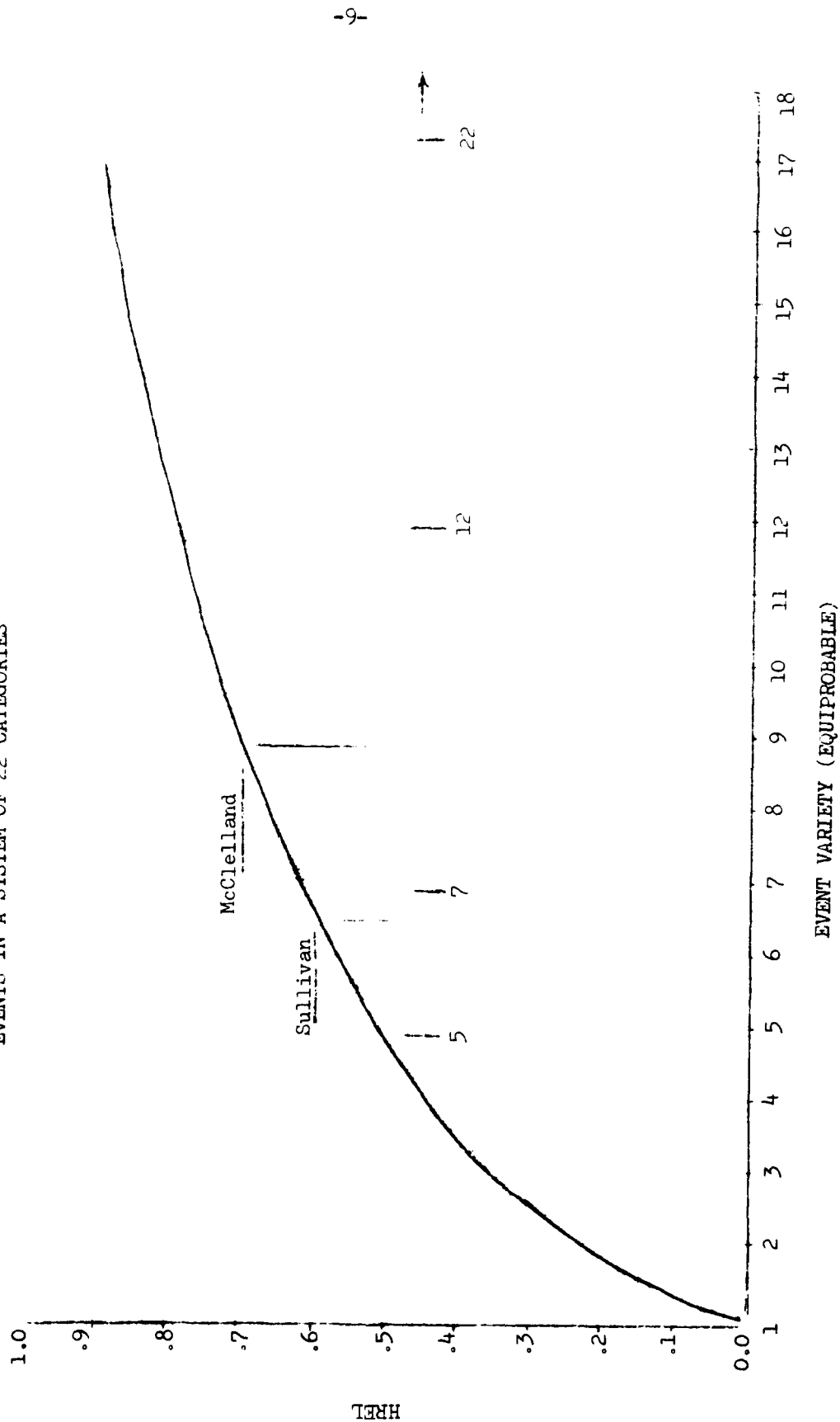
tives. The formulation for this measurement is a fractional relation-
ship between observed variety of events and its standard. The rela-
tionship takes the form:

$$HREL_{(relative)} = \frac{H_{observed}}{H_{maximum}} \qquad (2)$$

HREL may be defined as a relationship between an H-value for a
set of empirically observed events and a theoretical maximum H-value for
crisis conditions. HREL is the dependent variable and a direct function
of the observed events within a given period or span of time. We should
note that $H_{maximum}$ itself is subject to readjustment in accordance with
the number of event alternatives present in our set. Presently the WEIS
project is undertaking research in systems of seven, twelve, twenty-two,
and sixty-three behavior categories, and as noted earlier this paper is
concerned with the comparative performance of the 22 category system.
The Sullivan and McClelland crisis thresholds have been superimposed on
the plot of Figure 1 to indicate the minimum number of different events
that must be observed to attain, under ideal conditions, HREL values of
.600 and .700 respectively for 22 categories.

Application of HREL

This introduction allows us to apply HREL to the event/interaction
data for December 1970 and January 1971. Our discussion focuses first
upon a sample HREL computation, then examines the functional characteris-
tics of the computer model, and concludes with the results of our data
analysis.

    Example: Refer to Table 1 for illustration of processing.

In the month of June 1970 the following events were
observed in the frequencies indicated within the paren-
theses:
CONSULT (2); APPROVE (3); REWARD (2); PROPOSE (1);
REJECT (2); ACCUSE (3); DEMAND (8); DEMONSTRATE (1);
EXPEL (2); FORCE (1); All other events were not
observed.

Step 1. Calculate total frequency. (f=25)
Step 2. Calculate p for each event.
Step 3. Calculate h for each event utilizing equation (1d).

TABLE 1
CALCULATION OF H FOR 22 CATEGORY
WEIS BEHAVIOR SYSTEM

Event-Interaction Category	Frequency (f)	Probability (p)	Information (h)
YIELD	0	0	0
COMMENT	0	0	0
CONSULT	2	.08	.2915
APPROVE	3	.12	.3671
PROMISE	0	0	0
GRANT	0	0	0
REWARD	2	.08	.2915
AGREE	0	0	0
REQUEST	0	0	0
PROPOSE	1	.04	.1858
REJECT	2	.08	.2915
ACCUSE	3	.12	.3671
PROTEST	0	0	0
DENY	0	0	0
DEMAND	8	.32	.5260
WARN	0	0	0
THREATEN	0	0	0
DEMONSTRATE	1	.04	.1858
REDUCE RELATIONSHIP	0	0	0
EXPEL	2	.08	.2915
SEIZE	0	0	0
FORCE	1	.04	.1858
	25	1.00	

$H = 2.9826$

HMAX = 4.4610   (22 event alternatives)

$$HREL = \frac{H_{obs}}{H_{max}} = \frac{2.9826}{4.4610} = .6462$$

Step 4. Sum h to obtain $H_{observed}$ for the month of June 1970.

Step 5. Calculate HREL for June by employing equation (2).

HREL Monitor

The HREL computations are performed in accordance with four control parameters entered by the researcher before the commencement of processing.

1. The total number of unique behavior categories determines the maximum value of H for the situations to be examined. For this report we chose the 22 category system illustrated in Table 1.

2. The length of the analysis interval is specified in days. If we are investigating specific situations where the time boundareis are known, we could enter a time length sufficient to encompass the entire period. If on the other hand we want to examine the situation as it changes over time, we can specify shorter intervals and advance through it in the same manner as a salami slicer. The processor will compute values of HREL for each time slice. We have set the length of the slice at 31 days.

3. The begin and end dates allow the examination of only the required historical period. In this paper the monitor has been instructed to commence calculations on December 1, 1970 for time slices of 31 days and terminate calculations on January 31, 1971, resulting in two slices equating to the months of December and January.

4. The HREL threshold causes the program to flag all critical activity and output it for personal attention by the researcher. We have chosen the value 0.600 for the reasons cited earlier.

The HREL monitor will examine the following relationships for all 160 international actors now carried in the WEIS data collection:

a. Each nation to all other nations (total output).
b. All nations to each nation (total input).
c. All nation-to-nation (dyadic) relationships.

The permutation of possible interactions exceeds 26,000 combinations, hence all processing is internal to the computer with only critical or near critical relationships presented on an output device for the ana-

lyst's attention. Those flagged for December and January are presented in our discussion of findings.

HREL Findings

Table 2 is a rank order of all countries whose behavior was of sufficient variety to cause HREL to cross our suggested .600 threshold. Included are input, output, and dyadic relationships.

For the month of December we find no critical dyadic interaction, and from the total population of 160 international actors only eight are flagged on total input and output by the HREL monitor. The United States, Soviet Union, United Kingdom, and United Nations were flagged because of the wide variety of behavior they employ to meet their global commitments. Thus the total or aggregate behavior of superpowers and some great powers appears to saturate the monitor. The active participants on the world stage, when examined in terms of total output or input, display a wide range of activities, each judged appropriate to a particular circumstance. In many cases the circumstance involves very few nations and may reduce to a dyadic relationship. The United States is a case in point, where 125 observed acts were directed toward 25 targets. The distribution was uneven, with 5 targets receiving 6 or more acts and between them garnering 76% of the total U.S. output. All 5 USA-target relationships were of such limited variety that HREL failed to reach the threshold. Similar conditions prevailed for the United Kingdom, United Nations, and Soviet Union. What attracts our attention is the variety displayed by the more parochial, or regional, powers which for December would include East and West Germany, Israel, and the United Arab Republic. By their relatively heavy attention to local issues relevant to their immediate neighbors they appear to confine their interactions to a limited number of nations. We observed that these countries acted towards or received action from the following nations:

TABLE 2
RANK ORDER OF HREL INDICATORS
DETECTING SIGNIFICANT INTERACTIONS
OF NATIONS AND GROUPS OF NATIONS

December 1970   January 1971

OUTPUT

Action	Target	HREL		Action	Target	HREL
GME	ALL	.7462		USA	USR	.7548
USA	ALL	.7325		USA	ALL	.7357
USR	ALL	.7003		GME	ALL	.7135
UAR	ALL	.6757		USR	ALL	.7078
ISR	ALL	.6304		GMW	ALL	.6531
UNO	ALL	.6235		ECU	ALL	.6403
UNK	ALL	.6167		GME	GMW	.6381
				JOR	ALL	.6308
				USR	USA	.6228

INPUT

Action	Target	HREL		Action	Target	HREL
ALL	GMW	.7256		ALL	USR	.7770
ALL	ISR	.6841		ALL	UNK	.7040
ALL	MLG	.6802		ALL	MLG	.6960
ALL	UNO	.6779		ALL	GMW	.6856
ALL	UAR	.6751		ALL	USA	.6427
ALL	USA	.6101		ALL	UNO	.6110
ALL	USR	.6030				

East Germany (output)	United Arab Rep. (output)	Israel (output)	West Germany (intake)
West Germany	Israel	Unspecified	East Germany
Unspecified	Unspecified	UAR	Poland
West Berlin	Soviet Union	USA	Warsaw Pact
Warsaw Pact	USA	PLO	United Kingdom
Poland	Jordan	Soviet Union	Soviet Union
USA	United Nations	Lebanon	Spain
	United Kingdom	MLG	Guinea
	Pakistan		

The rank order shown includes the general targets "Unspecified" and "Multilateral Group" (MLG). The former is coded if an action originator does not direct the act at a specific target, while the latter represents nation groups which do not collectively constitute a recognized regional or global organization. Of the 96 observed events originated by these countries, only two (Guinea to West Germany; United Arab Republic (UAR) to Pakistan) were external to nations either contiguous to or involved with the United Arab Republic, Israel, and the two Germanies. Our indicator suggests that certain relations of the above nations are delicate or possibly in the process of change. A review of the December events may provide additional insights.

The German Democratic Republic's (GME) sensitivity to the Federal Republic's West Berlin political activity appears to set the tenor for their relations. The Christmas holidays traffic and communications were harassed by East German border guards, possibly in retaliation for this activity. An additional factor appears to be West German Chancellor Willy Brandt's visit to Poland, conclusion of a diplomatic agreement with Poland, and mutual praise between the two heads of government. East Germany criticized Poland and suggested closer Warsaw Pact cooperation. A seeming anomaly appears in Brandt's "OstPolitik" by his conciliatory moves towards Poland concurrent with the West Berlin political activities--especially when the latter is known to be a matter of extreme gravity to the Ulbricht regime. The somewhat sensitive East German relations with Poland may have been eroded by Brandt's Warsaw visit. East and West German economic matters appear detached from the political milieu, with the economic discussions enduring the political diatribe.

The significant reduction in activity of the United Arab Republic
and Israel was described in our November report. In December activity
again increased to pre-ceasefire levels for both countries and centers
primarily in appeals to supporters, world opinion and influential neutral
governments. UAR-Israel interaction was dominated by three events: the
UAR landing across the Suez canal, the Israeli sinking of a UAR ship in
the Gulf of Suez, and the UAR warning that it may not renew the cease-
fire. The broad range of activity requisite to higher HREL values was
occasioned by the UAR-Israeli hostility coupled with their continued
activities to seek and maintain support from their allies and friendly
neutral governments. The flurry of diplomatic activity originated by
President Sadat of the UAR is notable. Of 10 events observed on Decem-
ber 23rd, 7 were explanatory, 2 friendly, and 1 mildly hostile. The
friendly events were duplicate communications to President Nixon via the
good offices of the Pakistani and Jordanian governments. This may indi-
cate some alteration of the Egyptian position. Israeli actions appear
directed to maintenance of relations with the United States (15% of acts),
expressing concern over the plight of Jews in the Soviet Union (9%),
appeals to world opinion (28%), hostile exchange with the UAR (25%), and
conflict with the Palestine guerrilla forces (PLO--12%), with remaining
activity directed towards the United Nations, Lebanon, and miscellaneous
groups of nations.

The harassment of Soviet diplomats by members of the Jewish Defense
League (JDL) is reflected in U.S.-Soviet relations for January. The vio-
lence is indicated by the high HREL value for American action towards the
USSR, while the Soviet protests, warnings, and threats are observed in
the USSR response. The symmetry of this relationship (HREL indications
toward each other) suggests a critical or changing situation, and implies
that Soviet-American relations are suffering by the actions of the JDL.
We find, in addition, Soviet acts of sensitivity--as when their officials
took exception in public to certain editorials by domestic U.S. radio
stations criticizing internal Soviet affairs. Their cooperative behavior
in December contrasts with January when protests and threats over actions
by Jewish demonstrators at their New York cultural mission was met in

kind by the U.S. State Department, leading perhaps to the Soviet counter demonstration and harassments of Moscow-based U.S. officials and newsmen. The Middle East, SALT talks, Indochina, and Berlin figured prominently in U.S.-Soviet interaction but did not appear to substantially deviate from past practice.

The East Germans continued harassing Western traffic to Berlin, apparently displeased with the political visit of Chancellor Brandt to West Berlin. Violence flared with an attack upon a West German dredger. The hostile foreground contrasts with the Ulbricht regime's background efforts to gain West German diplomatic recognition and directly discuss Western access rights to Berlin. While the relatively low HREL (.6381) does not suggest a crisis it could imply concern or policy re-appraisal within the East German government. On the other hand we find no such indication from their West German counterparts. Brandt's OstPolitik appears to be reflected in a series of carrot and stick proposals to East Germany, ranging from accusations of attempts to sabotage relations to suggestions for discussion of the substantive issues.

Events surrounding the Ecuadorian seizures of U.S. tuna boats appear in the January data. The subsequent U.S. diplomatic protest and termination of military assistance failed to call the Ecuadorians to heel, although some substantive discussion was observed between respective government counterparts. Additional seizures, fines, and a move by Ecuador to carry the issue to discussions in the Organization of American States suggest that early resolution may remain remote.

The Jordanian expression of willingness to accept a Mideast settlement, suppression of the Arab guerrillas, discussions with Egypt, and exchanges with Syria described enough variety to attract our attention. In a manner similar to the UAR, Jordan appears to be undergoing policy reappraisals.

Table 3 summarizes the December 1970 and January 1971 rankings of nations exhibiting behavior levels significantly deviant from their average levels; it is based upon the proportion of indicators detecting this activity, as described by Hoggard in our November report. The asterisks mark nations whose deviant behavior was also detected during

TABLE 3
RANK ORDER OF PERCENTAGE INDICATORS
DETECTING SIGNIFICANT DEVIATIONS FROM
PREVIOUS BEHAVIOR (VOLUME)

December 1970			January 1971		
Country	Percent		Country	Percent	
WARSAW PACT	66.67		ECUADOR	83.50 (6) (0)	
EAST BERLIN	58.25		CAMEROUN	66.67	
HONG KONG	58.25		UGANDA	66.67	
ICELAND	50.00		VENEZUELA	58.25	
RWANDA	50.00		IRAN	58.25	
BURUNDI	50.00		SOUTH VIETNAM	41.65	
*VATICAN	41.65		GUINEA	41.65	
*NATO	41.65		SINGAPORE	41.65	
LUXEMBOURG	33.33		BARBADOS	33.33	
*NORTH VIETNAM	33.33		*NORTH VIETNAM	33.33	
*PORTUGAL	33.33		WEST GERMANY	25.00 (5) (4)	
BOLIVIA	25.00		CHILE	25.00	
EUROPEAN ECONOMIC COMM.	16.67		OAS	25.00	
WEST BERLIN	16.67		TANZANIA	25.00	
IVORY COAST	16.67		GHANA	16.67	
CAMBODIA	16.67		SENEGAL	16.67	
AUSTRALIA	16.67		*WEST BERLIN	16.67	
OAS	08.33		*EAST GERMANY	16.67 (3) (0)	
KUWAIT	08.33		*VATICAN	16.67	
SPAIN	08.33		URUGUAY	16.67	
EAST GERMANY	08.33 (1) (0)		USA	08.33 (2) (0)	
*ITALY	08.33		VIETCONG	08.33	
CZECHOSLOVAKIA	08.33		MULTI-LATERAL GROUP	08.33	
YUGOSLAVIA	08.33		NETHERLANDS	08.33	
*PAKISTAN	08.33				
OAU	08.33				

the preceding month. We have indicated in parentheses, for input and
output respectively, the rank order of countries that were also detected
by the HREL monitor. The coincidence is slight, 1 country in December
and 4 in January, but all five represent situations essential to the
participants' national interest: East and West Germany over Berlin;
the USA with the Soviet Union, North Vietnam, and Ecuador; and Ecuador
with the USA over seizure of the latter's tuna boats. In these affairs
the parties altered their proportional distribution of alternative
actions concurrent with an increase in the volume of interaction.

Tables 4 and 5 are detailed tabulations of the 12 specific indica-
tors. We have added columns for the event frequencies used in the devi-
ation calculations, because as the reader will note, 15 of 26 actors in
December and 8 of 24 actors in January were flagged for 2 or less events.
Their average activity level is low enough (ranging from 0.000 for Sene-
gal to 0.552 for Italy) to render the monitor especially sensitive to
any action originated by them. This contrasts with high activity nations
(USA: 75.877; Soviet Union: 32.421) whose intake and output must radi-
cally depart from the average in order to cross 2.0 standard deviation
threshold. This does not discount the appearance of the low profile
nations, but we suggest a more detailed examination of their reasons for
appearance. We found, for example, that receiving foreign guests is an
easy way into the news--East Berlin hosting a Warsaw Pact conference,
Pope Paul visiting Hong Kong and Australia, Pakistan the site of the
Arab nations foreign minister conference, and Italy receiving the U.S.
Secretary of Agriculture. In other activities, Bolivia released Regis
Debray and other guerrillas, while Rwanda and Burundi concluded a series
of political, economic, and cultural agreements. Thus each nation should
be examined on how it fits within its historical event stream. The high
level of Vatican activity we find quite in line with its past behavior--
explications on faith and morals, but with the present activity empha-
sized by the Pope's comments at each tour stop.

What may be more interesting is the implication of current situa-
tions when we compare the differences in the average activity levels of
the 60 and 12 month standards. Higher means for the 60 month history in

TABLE 4
DEVIATIONS FROM PREVIOUS ACTIVITY
BY BEHAVIOR TYPE

DECEMBER 1970

Total Activity

Country	Output				Intake			
	(N=59)	f	(N=12)	f	(N=59)	f	(N=12)	f
Luxembourg	2.205	(1)	3.175					
East Berlin	2.080	(1)	2.141				2.141	(1)
Vatican	2.786	(11)	2.119		2.032	(5)		
Warsaw Pact	4.959	(9)	4.422				2.225	(9)
Iceland	3.258	(1)	3.175					
Rwanda	3.583	(2)			3.190	(2)		
OAU	3.071	(6)						
North Vietnam	2.690	(62)			2.817	(63)		
Hong Kong	6.640	(2)	3.175		2.378	(2)	3.175	
Portugal					3.094	(7)	2.108	
EEC					2.532	(8)		
Burundi	2.196	(2)			2.235	(2)	2.000*	
West Berlin							3.528	(3)
NATO							4.335	(11)

Cooperative Behavior

Country	Output				Intake			
Luxembourg	2.205	(1)	3.175					
East Berlin	2.947	(1)	2.141		2.947	(1)	2.141	
Vatican	2.244	(9)						
Warsaw Pact	6.130	(8)	4.528		2.648	(6)		
Burundi	2.337	(2)	2.000*		2.430	(2)	2.000*	
Rwanda	3.710	(2)	2.000*		3.190	(2)	6.640	
Hong Kong	3.974	(2)	6.640		3.716	(2)	2.000*	
Bolivia			3.175	(1)				
OAS					2.985	(6)		
NATO					2.149	(8)	3.228	
EEC					2.808	(8)		

TABLE 4
DEVIATIONS FROM PREVIOUS ACTIVITY
BY BEHAVIOR TYPE

DECEMBER 1970

Total Activity

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Cooperative Behavior

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Vatican	2.244	(9)						
Warsaw Pact	6.130	(8)	4.528		2.648	(6)		
Burundi	2.337	(2)	2.000*		2.430	(2)	2.000*	
Rwanda	3.710	(2)	2.000*		3.190	(2)	6.640	
Hong Kong	3.974	(2)	6.640		3.716	(2)	2.000*	
Bolivia			3.175	(1)				
OAS					2.985	(6)		
NATO					2.149	(8)	3.228	
EEC					2.808	(8)		
Ivory Coast					2.337	(1)	3.175	
Kuwait							2.141	(1)

Conflictful Behavior

Country	Output				Intake			
Vatican	2.885	(2)						
Iceland	7.551	(1)	2.000*	(1)				
Cambodia	2.630	(36)			2.765	(38)		
North Vietnam	3.410	(59)			3.079	(55)		
Spain			3.175	(1)				
East Germany			2.828	(6)				
Italy			2.872	(2)				
Vatican			3.385	(2)				
Warsaw Pact			3.175	(1)			4.907	(3)
Australia			2.141	(1)	3.677	(1)		
Bolivia					3.677	(1)	2.000*	
Portugal					4.523	(7)	2.865	
NATO					2.884	(3)	4.907	
West Berlin							4.710	(2)
Czechoslovakia							3.175	(1)
Yugoslavia							2.000*	(1)
Pakistan							3.869	(2)

*No record of previous interaction.

TABLE 5
DEVIATIONS FROM PREVIOUS ACTIVITY
BY BEHAVIOR TYPE

JANUARY 1971

Total Activity

Country	Output (N=60)	f	(N=12)	f	Intake (N=60)	f	(N=12)	f
Barbados	2.372	(1)	2.000*					
Venezuela			2.141	(3)	3.089	(3)	3.175	
Ecuador	9.036	(10)	25.262		12.706	(7)	17.555	
Ghana			2.141	(1)				
Cameroun	3.710	(1)	2.141		7.686	(2)	4.710	
Uganda	7.138	(8)	8.949					
Iran	4.097	(8)	11.343					
Chile							3.869	(4)
OAS					3.417	(4)	2.189	
North Vietnam	2.102	(52)			2.732	(6)	4.424	
South Vietnam	2.724	(31)			2.387	(59)		
Senegal					3.450	(32)		
Guinea	2.517	(7)					2.141	(1)
Singapore	5.606	(7)						

Cooperative Behavior

Country	Output (N=60)	f	(N=12)	f	Intake (N=60)	f	(N=12)	f
Venezuela	3.168	(3)	2.218		4.124	(3)	3.175	
Ecuador	4.430	(3)	10.104		6.528	(3)	7.279	
West Berlin	2.093	(2)					3.385	(2)
Cameroun	4.322	(1)	3.175		8.872	(2)	6.640	
Uganda	5.886	(4)	6.640					
South Vietnam	2.303	(15)						
Singapore	4.654	(5)	6.653					
Ghana			2.141	(1)				
Iran			5.360	(4)				
OAS							5.360	(4)
							4.424	(6)

Conflictful Behavior

| Country	Output (N=60)	f	(N=12)	f	Intake (N=60)	f	(N=12)	f
USA	3.536	(42)						
Barbados	2.000*	(1)	2.000*					
Ecuador	9.696	(7)			17.972	(4)	2.000*	
West Germany	2.826	(7)	2.182		3.352	(12)		
East Germany	2.426	(9)	3.651					
Vatican	5.959	(4)	5.191					
Guinea	5.676	(7)	3.425		6.503	(8)	5.254	
Uganda	6.671	(4)	13.568		4.322	(1)	3.175	
Tanzania	2.287	(2)	2.815				2.000*	(2)
Iran	7.475	(4)	2.000*					
North Vietnam	2.546	(51)			2.516	(50)		
South Vietnam	2.587	(16)			4.111	(22)		
Viet Cong	2.208	(17)						
Singapore	5.365	(2)	6.640					
Multi-lateral Grp.			3.582	(3)				
Uruguay					3.710	(1)	3.175	
Chile							6.640	(2)
Netherlands							3.175	(1)
Senegal							2.000*	(1)

*No record of previous interaction.

comparison to its 12 month counterpart may indicate a possible halt or reversal of the situation described by the indicator. Conversely, for occasions when the mean level for n = 12 is greater, the condition is increasing or has increased in relation to the long term average. The behavior of Ecuador for the month of January illustrates the point. Observations over the past 5 years indicate for Ecuador an average cooperative level of about .300 observed acts per month, but the last 12 months reveal no friendly acts or a mean of 0.000. Concurrently we expect about .233 acts per month of a hostile nature, but this too is zero. Ecuador is indeed displaying a low profile. Her withdrawal from active inter-American activity was itself a point of interest, underlined now by the sudden re-eruption of the seemingly dormant tuna issue.

The spontaneity of events are indicated by the relative presence/absence of the n = 60 and n = 12 deviations for the same observation period. Deviations reflected in n = 60 are abnormal with respect to long-term behavior averages and in the absence of similar indications for n = 12 (short term), implies intense activity in the indicator category. When short-term deviations are present and long-term absent we could be observing a stand down or change in a nation's behavioral state. The Cambodian and North Vietnamese conflictual behavior in December serve to illustrate—the former was triggered by the American incursion of May 1970 and the latter by their greater efforts to counter the aggressive efforts of the South Vietnamese to cut the Ho Chi Minh Trail. A similar situation prevails for North Vietnam, South Vietnam, and the Vietcong in January. A projection suggests similar happenings in the February data for Laos.

The approaching Christmas Season and New Year's led us to question the effects of holidays upon the flow of events. Figures 2 and 3 illustrate the total event flow we observed during December and January respectively. The dip extending from December 12 through the 17th appears as the only significant departure from the more conventional alternating peaks and valleys characteristic of our data. The five days following Christmas Day resemble the activity of the first weeks. With a mean level of 23.451 events per day, December activity is within 3% of the

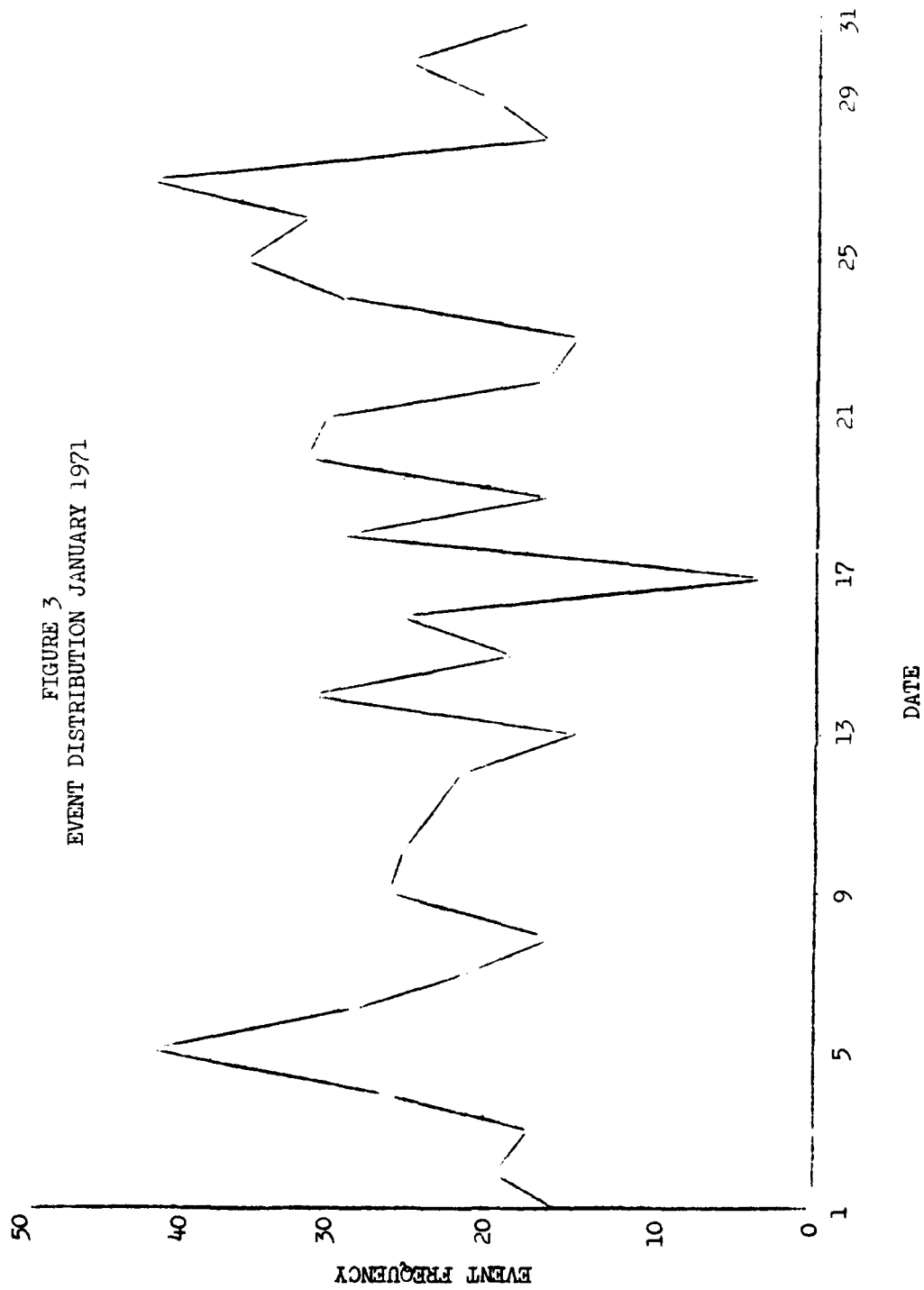FIGURE 2
EVENT DISTRIBUTION DECEMBER 1970
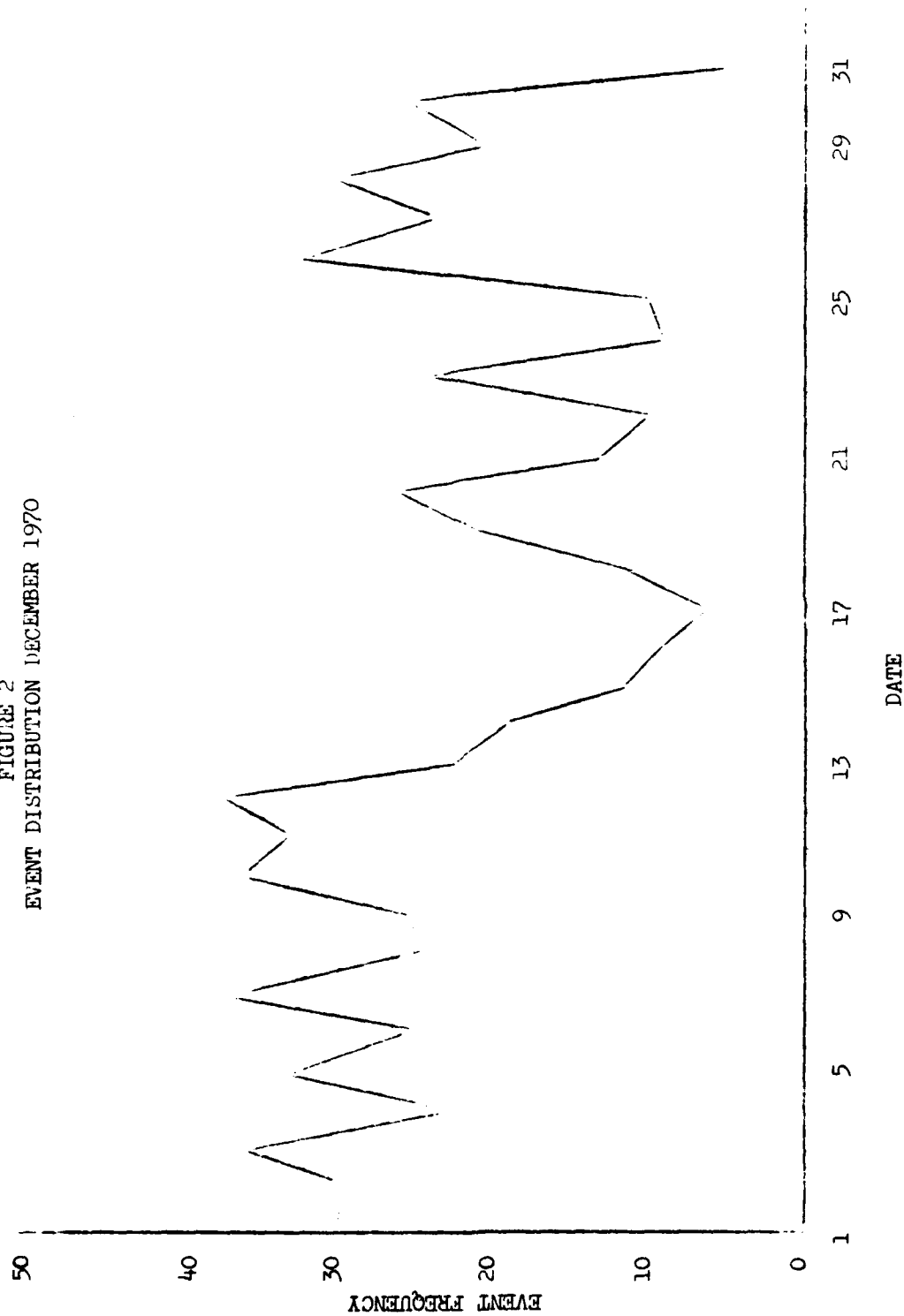
FIGURE 3
EVENT DISTRIBUTION JANUARY 1971

January level of 24.129.

Table 6 is a summary of the major pairs of interacting countries
rank ordered by the number of observed events. An arbitrary lower limit
of 6 events was the cutoff. In both months the Indochina and Mideast
arenas dominate the activity. In December interaction related to Indo-
china accounted for 59% of the observed events, followed by the Middle
East with 24%. January witnesses a drop in the proportional dominance
of both arenas—37% and 18% respectively. This appears occasioned by
the marked increase of American policy explication via general pro-
nouncements on Cambodia, the Strategic Arms Limitation talks, the Nixon
Doctrine, the progress of American withdrawal from Indochina, and con-
cern about the Soviet missile submarine base in Cuba. The controversy
with Ecuador appears in January as do the East and West German activi-
ties surrounding the Berlin issue. The high activity dyads presented
earlier in Table 6 comprise 49% of the total observed events for Decem-
ber, and 56% for January. The remaining interactions are shared among
interacting nations with 5 or less observed events per month. The
difference in emphasis between raw event frequencies for single time
periods and their standard deviations based upon previous behavior is
illustrated if we contrast Tables 3 and 6. In Table 6, with the excep-
tion of the Ecuadorian and Berlin situations in January, the open conflict
situations in the Middle East and Vietnam submerge all lower level activi-
ties, whereas Table 3 suggests that comparisons with past behavior fil-
ters much of the high-volume flow (including on-going conflicts) while
emphasizing significant departures from this event stream. In contrast
to the measure of interaction levels we find in Table 2 that variety
dominates volume. U.S. interaction with the Soviet Union in January
reaches an HREL of .7548 for 19 events, while 32 events of U.S.-Vietcong
interaction do not reach our .600 threshold. The Soviet Union-USA, and
East-West German interaction, while of moderate volume, register HREL
values of .6228 and .6381 respectively, with the latter larger figure
calculated from less events.

*   *   *   *   *

TABLE 6
PRIMARY ACTOR-TARGET INTERACTIONS

December 1970				January 1971		
Actor	Target	Frequency		Actor	Target	Frequency
VTN	USA	41		USA	NSC	66
USA	NSC	37		USA	VCG	32
USA	VTN	34		VTN	CAM	21
VTN	CAM	33		VTN	USA	21
CAM	VTN	30		USA	USR	19
VTS	VTN	16		CAM	VTN	17
VTN	VTS	15		UAR	NSC	17
PLO	JOR	15		VTN	VTS	15
UAR	ISR	13		VTS	VTN	15
UAR	NSC	13		JOR	PLO	14
JOR	PLO	12		PLO	JOR	13
VCG	VTS	11		USR	USA	13
VTS	VCG	10		USR	NSC	11
ISR	NSC	9		GME	GMW	11
USA	USR	9		VTS	NSC	10
VCG	USA	9		VTS	CAM	10
USA	VCG	8		USA	VTS	8
ISR	USR	8		USR	USA	8
USR	UAR	8		ECU	USA	8
USR	USA	8		CAM	VTS	7
JOR	NSC	8		USA	CAM	7
USA	UAR	6		USA	ECU	7
				VCG	USA	7
		353		UAR	ISR	7
				GMW	GUI	6
				VCG	VTS	6
				UAR	UNO	6
				UNO	NSC	6
				ISR	NSC	6
				ISR	UNO	6
				FRN	NSC	6
				JAP	NSC	6
				LAO	NSC	6
						418

Our first three reports have presented two simple monitoring procedures to evaluate ongoing international interaction. We have suggested that insights may be gained by monitoring significant deviations from the average behavior levels of past activity. We also find promising the comparison of event variety with hypothesized non-routine conditions. We believe each method will contribute to the development of an interaction monitoring procedure sensitive to changes in the type and level of international behavior. Our efforts in the direction of developing the interaction monitor are complemented by a concurrent program for short-term projection of the international environment. This research has extended along two fronts--the systemic level where event flows and selected indicators, based upon past relationships, are projected into the future, and national behavior groups based upon performance in crisis and non-crisis situations. With the former we hope to suggest general conditions in the near-term international environment, and with the latter insights on possible alternative actions chosen by nations when confronted with crisis-potential situations. The status of these efforts will be included in this report as results become available.

FOOTNOTES

1. Gary D. Hoggard, "Preliminary Report on a Procedure for Monitoring International Interaction," World Event/Interaction Survey, University of Southern California, November 15, 1970.

2. Gary D. Hoggard, "Status Report on International Interaction--November 1970," World Event/Interaction Survey, University of Southern California, December 15, 1970.

3. C. E. Shannon, "Prediction and Entropy of Printed English," Bell System Technical Journal, No. 30, 1951, pp. 50-64. Additional references pertinent to our application include:
C. E. Shannon and W. Weaver, The Mathematical Theory of Communication. Urbana: University of Illinois Press, 1949.
Wendell R. Garner, Uncertainty and Structure as Psychological Concepts. New York: Wiley, 1962.
Fred Attneave, Applications of Information Theory to Psychology: A Summary of Basic Concepts, Methods and Results. New York: Holt, Rinehart and Winston, 1959.
Charles E. Osgood and Kellogg Wilson, Some Terms and Associated Measures for Talking About Human Communication. Urbana: Institute of Communications Research, University of Illinois, 1961.
Colin Cherry, On Human Communication. Cambridge, Mass.: Technological Press of the Massachusetts Institute of Technology, 1957.

4. Charles A. McClelland, "Action Structures and Communication in Two International Crises: Quemoy and Berlin," Background, Vol. 7 (February, 1964), pp. 201-215.

_____, "The Access to Berlin: The Quantity and Variety of Events 1948-1965," Quantitative International Politics (J. David Singer, ed.), New York: The Free Press, pp. 159-196.

_____, "The Acute International Crisis," World Politics, Vol. 14 (October 1961), pp. 192-204.

5. Ibid.

6. John D. Sullivan, "Quemoy and Matsu: A Systematic Analysis," (mimeograph). San Francisco: San Francisco State College, 1964.

7. Shannon, "Prediction and Entropy of Printed English."